Final Result of Mice Neuron Activity

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Contents

- Dataset: Zero Elevated Maze
- Model:
  - GLM
  - GLM after PCA
  - RNN - LSTM
- Six mouse: 409, 412, 414, 416, 417, 418
- Drop: zero behavior in both columns
- Output: closed_arm
- Input:
  - All neurons for GLM,
  - Parallel analysis suggested PCs for GLM
  - All neurons for RNN
- Data split: 70% training, 30% test
- Accuracy: Confusion Matrix

Table 1: Comparison of GLMs for Six Mouse

Mice	Total_neurons	Accuracy	AUC_score
409	110	0.8955	0.9582
412	100	0.9403	0.9623
414	33	0.7373	0.7870
416	26	0.7271	0.7852
417	79	0.9476	0.9684
418	77	0.9168	0.9505

$$glm(closed.\,arm \sim .\,, data = train.\,close, family = binomial(" logit "))$$

PCA

- KMO: Sampling Adequacy
- Parallel Analysis: to extract number of principal components

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Importance of components:
                    PC1     PC2     PC3     PC4     PC5     PC6     PC7     PC8     PC9
Standard deviation  4.7891  2.85031 2.43991 2.22517 1.87711 1.69724 1.63653 1.54620 1.4263
Proportion of Variance 0.2085 0.07386 0.05412 0.04501 0.03203 0.02619 0.02435 0.02173 0.0185
Cumulative Proportion  0.2085 0.28236 0.33648 0.38149 0.41352 0.43971 0.46406 0.48579 0.5043
                    PC10    PC11    PC12    PC13    PC14    PC15    PC16    PC17    PC18
Standard deviation  1.38575 1.34762 1.31689 1.2455  1.22416 1.18976 1.17891 1.16566 1.14622
Proportion of Variance 0.01746 0.01651 0.01577 0.0141 0.01362 0.01287 0.01263 0.01235 0.01194
Cumulative Proportion  0.52175 0.53826 0.55402 0.5681 0.58175 0.59462 0.60725 0.61960 0.63155
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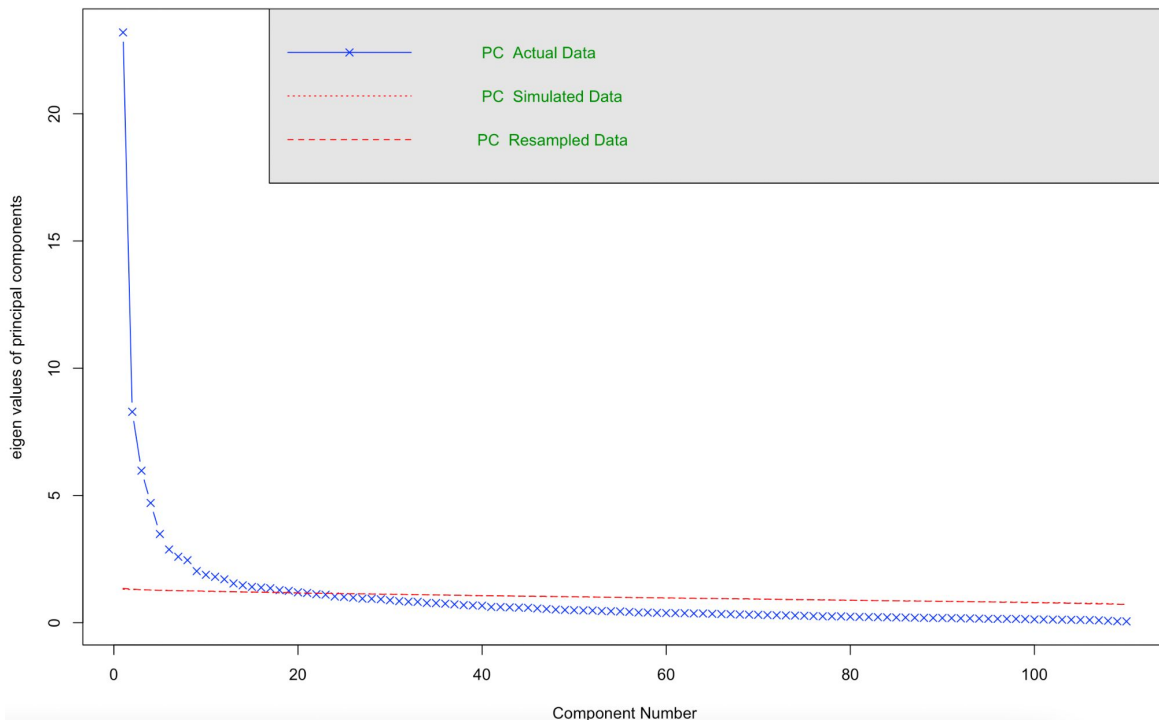
Parallel Analysis Scree Plots

Table 2: Comparison of GLM after PCA

Mice	KMO	PC_number	Accuracy	AUC_score
409	93	24	0.8109	0.8710
412	77	27	0.8385	0.8520
414	80	11	0.6587	0.7069
416	61	11	0.7033	0.7365
417	73	24	0.9012	0.9015
418	78	24	0.8573	0.8737

$glm(closed.\,arm \sim .\,, data = train.\,close, family = binomial("\,logit\,"))$

RNN-Long term and short term memory

- Using the frequency of neurons for prediction, and predicting the outcome of binned behavior
- Batched size & Epochs
- Activation = "sigmoid", convert linear function into probability between zero and one
- Loss = 'binary_crossentropy', since our outcome is binary
- Validation_split: 20%
- Build confusion matrix to evaluate our accuracy

Table 3: Comparison of RNN for Six Mouse

Mice	neuron_number	Batch_size	Epoch	Accuracy	loss
409	110	20	15	0.9533	0.2100
412	100	15	10	0.9886	0.0458
414	33	10	15	0.8937	0.4082
416	26	15	15	0.9270	0.2276
417	79	15	10	0.9728	0.1358
418	77	15	15	0.9597	0.1632

Comparison of Three Models
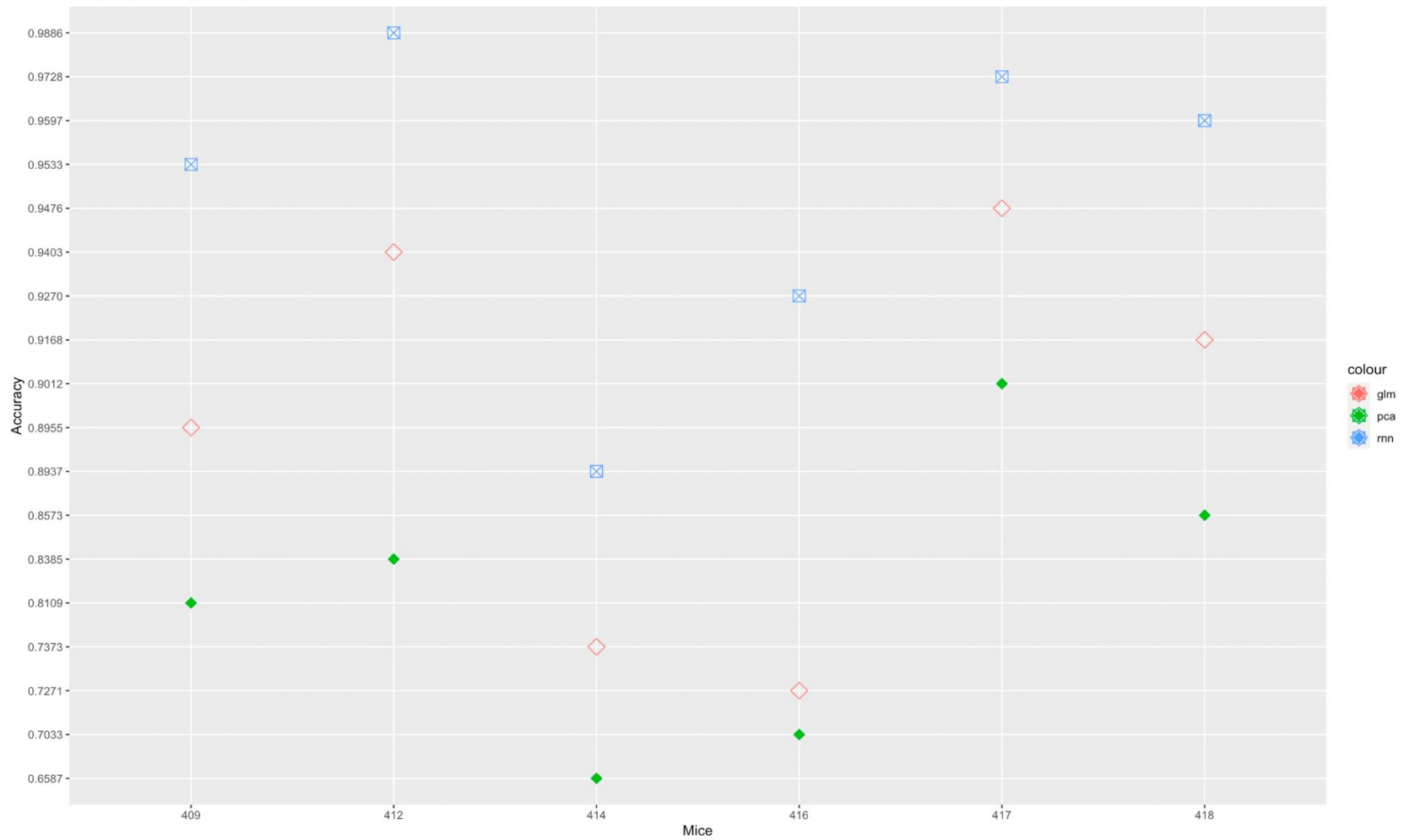
Challenges and Improvements

- Sampling Adequacy
- Calculational Expenses:
  - Number of neurons
  - batch_size and epochs
  - Time interval
- Model Accuracy: how to avoid overfitting?